

My Spacecraft to Saturn

Illustration of Cassini approaching Saturn.



LESSON TIME

1 hour

MATERIALS CHECKLIST

For the teacher:

- Copy of “Summary of Spacecraft Design Problems” to read aloud

For each student:

- Copy of “Designing Your Spacecraft Worksheet”
- Pencil
- Paper
- Saturn Discovery Log

LESSON NO. 6

- *Language Arts Focus*
—Nonfiction Reading and Writing as Tools for Problem-Solving
—Nonfiction Reading Practice: Summary
- *Science Focus* — *Thinking Like an Engineer: Problem-Solving Spacecraft Design*

OVERVIEW

In this lesson, students get the chance to think like engineers as they are presented with problems that the NASA team faced when designing a spacecraft to travel to Saturn. Students work with partners to think of solutions to address those problems, and use these ideas to sketch their spacecraft. In the next lesson, students have the opportunity to compare their ideas to the ideas of the NASA team. This is a unique opportunity for children to gain an insider’s look at the world of engineering.

WHY THIS WORKS

The National Science Education Standards state that children should be able to design solutions to problems. This exposure to design in the younger grades provides the groundwork for more sophisticated work in later grades. Drawing illustrations with accompanying text is a powerful way for children to organize and express their thinking. Nonfiction writers often rely on illustrations with text to explain difficult concepts, so students benefit from repeated exposure to creating and learning from illustrations with text.

Objectives

Students will:

- Practice working with a partner to think of ideas to solve problems.
- Practice communicating solutions clearly.
- Practice communicate ideas using illustrations with text.

Teacher Preparation

Print out a copy of teacher reference 1: “Summary of Spacecraft Design Problems” to read aloud. Make a copy for each student of student handout 1, “Designing Your Spacecraft Worksheet” (4 pages). Decide how to pair students.



What to Do

Model Problem Solving — Suggested time 10 minutes

1. Tell your class that they are going to be working today to design a spacecraft to go to Saturn.
2. Read “Summary of Spacecraft Design Problems” aloud to your class.
3. Ask students to turn to a partner and spend a few minutes brainstorming a way to keep the spacecraft from burning up when it leaves Earth.
4. Collect ideas from the class.
5. Tell your students that they will be put into pairs to work as a design team and will be given a worksheet to complete, and that at the end of the class, each team will choose one or two things from their worksheet to share with the other students.
6. Give each pair of students a copy of the “Designing Your Spacecraft Worksheet.”

Design the Spacecraft — Suggested time 35 minutes

1. Ask the design teams to proceed in designing their spacecraft.
2. Circulate throughout the room to assist the students as they complete their worksheets.

Share with the Class — Suggested time 15 minutes

1. Have students choose a part of their spacecraft designs to share with their classmates, and decide how they will present together (who shares what part).
2. Ask the design team pairs to come up and present something from their worksheets.
3. Have the class share things they like about each other’s work, questions they have, and suggestions for the presented designs.
4. Ask students to put their name and date on their work, decide which partner will store it, and put it inside the Saturn Discovery Log. (You may want to offer to make a copy of the work, so that each student can have the work in his/her Saturn Discovery Log.)

Extensions

Write a Descriptive Paragraph

1. Have the students write a paragraph describing everything about their spacecraft.
2. For an extra challenge, you can hang the sketches of spacecraft around the room, and have the class work in pairs to match descriptive paragraphs to the actual sketches.



Assessment

While children are working, ask yourself the following question:

- Are the students able to problem solve successfully with partners?

If they are able to do this, take notes on what you see these pairs doing and saying, and share these with your class. You may want to do this without mentioning names. If students are not, try to notice what is interfering: the way they are sitting, eye contact, etc. and share these observations with your students as well as goals for future partner work.

As you read over the children's work, ask yourself the following question:

- Were the students able to devise creative solutions to design problems?

This is a difficult skill for this age group, and the purpose of this activity is merely to provide beginning exposure to the scientific skill. However, if you notice students that shine in this area, take note of this so that so you can encourage that student's talent.

Standards

National Council of Teachers of English and International Reading Association Standards for the English Language Arts

All students must have opportunities to:

- Read a wide range of print and nonprint texts.
- Employ a wide range of strategies as they write and use different writing process elements appropriately to communicate with different audiences for a variety of purposes.
- Participate as knowledgeable, reflective, creative, and critical members of a variety of literacy communities.
- Use spoken, written, and visual language to accomplish their own purposes (e.g., for learning, enjoyment, persuasion, and the exchange of information).

National Science Education Standards

As a result of their activities in grades K–4, all students should develop:

- Understanding of properties of objects and materials (Physical Science).
- Abilities of technological design (Science and Technology).
- Understanding about science and technology (Science and Technology).
- Understanding of science as a human endeavor (History and Nature of Science).



Summary of Spacecraft Design Problems

Introduction

Behind the Scenes (from a visitor to the Jet Propulsion Laboratory)

In a few minutes, you will hear a summary of the problems that engineers faced when they started designing a spacecraft to go to Saturn. I visited the Jet Propulsion Laboratory in Pasadena and talked to the engineers who built the spacecraft that is going to Saturn. It was cool to visit there! You get to see mission control where they track the progress of lots of different spacecraft, and you can see a room that looks like Mars where they are testing rovers to see how they might work on Mars. The engineers are very excited about their spacecraft. I took 26 pages of notes! Then I needed to decide what to write about, because I don't think you want to hear all 26 pages, do you? I decided to list the most common problems that engineers face when they are building a spacecraft. There are millions of other problems that engineers faced too, but some of them you and I would have no idea how to solve unless we got a degree in engineering. I hope you enjoy hearing this summary.

Designing a Spacecraft

Today you are going to need to think like an engineer. Many of the people who work at NASA are engineers. Engineers at NASA design instruments to help scientists discover things.

Here is your design problem for today. How can you design a spacecraft that will make it all the way to Saturn — 800 million miles away from Earth? To design your spacecraft, you and your partner are going to work together and make decisions about the following things.

- How will you keep the spacecraft from freezing in the icy cold temperature of deep space?
- How will you control and keep in touch with your spacecraft?
- How will you keep the spacecraft safe if it is hit by a space particle (a micrometeoroid, dust particle, or ring particle)?
- What do you want the spacecraft to try to find out at Saturn?
- Do you think you should send humans on the spacecraft? If you think you should send humans, how will they survive?
- What are some things that could go wrong with the spacecraft on the journey to Saturn?
- What will you name your spacecraft?
- Why did you choose that name?

Once you think of possible solutions to these design problems, you and your partner are going to draw a sketch of your Saturn spacecraft!



Designing Your Spacecraft Worksheet



A note to the Design Team Members: Before you start working, read these "words of wisdom" from Marcus Angelo Watkins (Marc), a spacecraft engineer who works at NASA's Jet Propulsion Laboratory. Marc helped develop the antenna system and power and propulsion systems for the Cassini spacecraft.

"Life is about learning, whether it is how to tie your shoe or how to fly an airplane. You learn from listening, observing, and questioning. Take chances!!! Try almost anything as long as it will not hurt you! You are a unique individual and there is only one of you! Develop yourself into whatever you want."

Date of Design: _____

Names of Design Team Members: _____

Directions to the Design Team: Talk about the following questions with your partner, and write down your ideas for solving each problem.

1. How will you keep the spacecraft from freezing in the icy cold temperature of deep space?

2. How will you control and keep in touch with your spacecraft?



3. How will you keep the spacecraft safe if it is hit by a space particle (a micrometeoroid, dust particle, or ring particle)?

4. What do you want the spacecraft to try to find out at Saturn?

5. Do you think you should send humans on the spacecraft? If you think you should send humans, how will they survive?



6. What are some things that could go wrong with the spacecraft on the journey to Saturn?

7. What will you name your spacecraft?

8. Why did you choose that name?



9. Draw the design of your spacecraft. Use arrows and write words to explain what its parts do. Make sure you include your answers from questions 1-8 in your sketch. After you finish your drawing, go back through questions 1-8 and make sure all of your ideas are shown in your sketch.

